NuScaleDCRaisPEm Resource

From: Cranston, Gregory
Sent: Monday, January 08, 2018 10:22 AM
To: RAI@nuscalepower.com
Cc: NuScaleDCRaisPEm Resource; Lee, Samuel; Chowdhury, Prosanta; Burkhart, Lawrence; Lavera, Ronald; Markley, Anthony
Subject: Request for Additional Information No. 327 RAI No. 9257 (12.2)
Attachments: Request for Additional Information No. 327 (eRAI No. 9257).pdf

Attached please find NRC staff's request for additional information concerning review of the NuScale Design Certification Application.

Please submit your technically correct and complete response within 60 days of the date of this RAI to the NRC Document Control Desk.

If you have any questions, please contact me.

Thank you.

Gregory Cranston, Senior Project Manager
Licensing Branch 1 (NuScale)
Division of New Reactor Licensing
Office of New Reactors
U.S. Nuclear Regulatory Commission
301-415-0546

Hearing Identifier: NuScale_SMR_DC_RAI_Public
Email Number: 354

Mail Envelope Properties (CY4PR09MB1287D6414D1FE8E31461976A90130)

Subject: Request for Additional Information No. 327 RAI No. 9257 (12.2)
Sent Date: 1/8/2018 10:22:14 AM
Received Date: 1/8/2018 10:22:18 AM
From: Cranston, Gregory

Created By: Gregory.Cranston@nrc.gov

Recipients:
"NuScaleDCRaisPEm Resource" <NuScaleDCRaisPEm.Resource@nrc.gov>
Tracking Status: None
"Lee, Samuel" <Samuel.Lee@nrc.gov>
Tracking Status: None
"Chowdhury, Prosanta" <Prosanta.Chowdhury@nrc.gov>
Tracking Status: None
"Burkhart, Lawrence" <Lawrence.Burkhart@nrc.gov>
Tracking Status: None
"Lavera, Ronald" <Ronald.LaVera@nrc.gov>
Tracking Status: None
"Markley, Anthony" <Anthony.Markley@nrc.gov>
Tracking Status: None
"RAI@nuscalepower.com" <RAI@nuscalepower.com>
Tracking Status: None

Post Office: CY4PR09MB1287.namprd09.prod.outlook.com

Files	Size	Date & Time
MESSAGE	556	1/8/2018 10:22:18 AM
Request for Additional Information No. 327 (eRAI No. 9257).pdf	106553	

Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

Request for Additional Information No. 327 (eRAI No. 9257)

Issue Date: 01/08/2018
Application Title: NuScale Standard Design Certification - 52-048
Operating Company: NuScale Power, LLC
Docket No. 52-048
Review Section: 12.02 - Radiation Sources
Application Section: 12.2, 12.3, 1.8, 16.5, 5.4

QUESTIONS

12.02-14

Regulatory Basis

10 CFR 52.47(a)(5) requires applicants to identify the kinds and quantities of radioactive materials expected to be produced in the operation and the means for controlling and limiting radiation exposures within the limits set forth in part 20 of this chapter. 10 CFR 20.1101(b) and 10 CFR 20.1003, require the use of engineering controls to maintain exposures to radiation as far below the dose limits in 10 CFR Part 20 as is practical. 10 CFR Part 50 Appendix A, criterion 4 requires applicants to identify the environmental conditions, including radiation, associated with normal operation. The DSRS Acceptance Criteria section of NuScale DSRS section 12.2 “Radiation Sources,’ states that the applications should contain the methods, models and assumptions used as the bases for all sources described in DCD Section 12.2. The DSRS Acceptance Criteria 12.3-12.4, “Radiation Protection Design Features,” states that the areas inside the plant structures, as well as in the general plant yard, should be subdivided into radiation zones, with maximum design dose rate zones and the criteria used in selecting maximum dose rates identified.

Background

NuScale DCD Tier 2, Revision 0 Section 12.2.1.3, “Chemical and Volume Control System,” states that at the end of the fuel cycle, a crud burst is assumed, with the mixed-bed demineralizers being loaded with the entire radionuclide inventory increased due to the crud burst. This increase in radionuclide concentration in the primary coolant is determined by a review of industry data of increased radionuclide concentrations during crud bursts. The resulting crud burst peaking factors are listed in DCD Table 12.2-6, “Chemical and Volume Control System Component Source Term Inputs and Assumptions.” This table lists the peaking factors to be applied to the normal reactor coolant system (RCS) activity expected to be contained in Chemical and Volume Control System (CVCS) liquid following a crud burst during an outage. DCD Section 12.2.3, “References,” references Electric Power Research Institute (EPRI), "Pressurized Water Reactor Primary Water Chemistry Guidelines," Volumes 1 and 2, EPRI 3002000505, Palo Alto, CA, Revision 7, April 2014. NuScale Technical Specification Section 5.5.4, “Steam Generator (SG) Program,” states the requirement for a Steam Generator program. DCD Table 1.8-2: “Combined License Information Items,” COL Item 5.4-1: states that the Steam Generator Program will be based on NEI 97-06, “Steam Generator Program Guidelines,” Revision 3 and applicable EPRI steam generator guidelines. One of the elements of the program is to include primary water chemistry controls. EPRI TR-3002000505 states that crud-related phenomena have occurred which have negatively impacted plant operations and core performance, such as anomalous crud releases and elevated radiation fields during refueling outages, crud induced power shift (CIPS, formerly called axial offset anomaly, AOA), and crud induced fuel failures. A frequently used expression to separate some PWRs with more aggressive core designs from others is to refer to these units as "high duty cores," which can give rise to enhanced corrosion product deposition in the core. The "high duty core index," (HDCI) methodology was developed and incorporated into the PWR Axial Offset Anomaly (AOA) Guidelines. This index serves as a screening tool for the susceptibility to enhanced crud deposition in the core. Because corrosion and wear products that spend longer periods in high neutron fluxes, such as material deposited on fuel surfaces, will have much higher specific radioactivity. Therefore plants with high HDCIs are subject to higher than normal specific activity crud bursts. Higher activity crud burst challenge the ability of plant systems to control airborne radioactive material, minimize surface contamination, reduce effluent releases and to control occupational radiation exposure.

Key Issue:
Using the methodology described in EPRI TR-1008102, “PWR Axial Offset Anomaly (AOA) Guidelines, Revision 1,” appendix F “Definition of High Duty Core (A Means for
Evaluating the Propensity to Deposit Crud on Fuel Assemblies),” the staff determined that based, on the core power density, heat flux, coolant flow rates etc. described in the relevant sections of the DCD, that the NuScale plant could also be classified as a High Duty Plant. The crud burst peaking factors listed in DCD Table 12.2-6 are based on operational data from plants without HDCI, and may understate the estimated crud burst.

Question

To facilitate staff understanding of the application information sufficient to make appropriate regulatory conclusions with respect to radiation exposures, the staff requests that the applicant:

- Describe how outage RCS activity estimates factor into the potential for increased material deposition on core surfaces due to the operating parameters of the NuScale design,
- As necessary revise DCD Table 12.2-6, to include increased crud deposition and activation,
- As necessary revise the radiation zone maps to account for any increased dose rates due increased crud deposition and activation,
- As necessary revise Table 12.2-33: “Reactor Building Airborne Concentrations,” to account for any increased dose rates due increased crud deposition and activation,
- As necessary revise Table 12.2-7: “Chemical and Volume Control System Component Source Terms - Radionuclide Content” to account for any increased dose rates due increased crud deposition and activation,
- Provide information on design features provided to reduce crud buildup in the core,

OR

Provide the specific alternative approaches used and the associated justification.